

# **DEVICE USED FOR DETECTING CLAMPING FORCE OF PROCESSED OBJECT AND METHOD THEREOF**

## **Field of the invention**

The present invention relates to a device used for detecting the clamping  
5 force of a processed object and a method thereof, whereby the magnitude of the  
clamping force can be detected to adjust the spacing between pivotal rods,  
hence avoiding a too large or too small clamping force between the pivotal  
rods.

## **Background of the invention**

10 Figs. 1 and 2 show a wafer cleaning apparatus for cleaning the surface of a  
processed object 10. The processed object 10 is a wafer or another object. The  
wafer cleaning apparatus utilizes a first pivotal rod set 20 and a second pivotal  
rod set 30 to clamp the periphery of the processed object 10, and utilizes  
pivotal rods 21 of the pivotal rod sets 20 and 30 to support and rotate the  
15 processed object 10. There are also two cleaning wheels 40, which are  
respectively moved to upper and lower end faces of the processed object 10 and  
rotate to clean the processed object 10.

As shown in Fig. 3, during the maintenance of the wafer cleaning apparatus,  
the spacing between the first pivotal rod set 20 and the second pivotal rod set  
20 30 is adjusted to adjust a force for clamping the processed object 10, and a  
level 50 is placed at the upper end face of the processed object 10 to determine  
whether the processed object 10 clamped between the pivotal rod sets 20 and  
30 is level.

However, the above conventional apparatus and a method thereof for  
25 adjusting the clamping force of a processed object have the following

drawbacks.

1. The above conventional device and the method thereof for adjusting the clamping force of a processed object utilize the level 50 as a adjustment tool, and experiences are exploited to determine whether the processed object 10 clamped between the pivotal rod sets 20 and 30 is level, thereby adjusting the force for clamping the processed object 10 between the pivotal rod sets 20 and 30. The force for clamping the processed object 10 between the pivotal rod sets 20 and 30 cannot be obtained in quantitative way. Therefore, the adjustment of the clamping force of the pivotal rods is inconvenient.
2. The above conventional device and the method thereof for adjusting the clamping force of a processed object utilize the level 50 for adjustment of the force for clamping the processed object 10 between the pivotal rod sets 20 and 30. Accumulation and teach-and-learn of experiences are required. The operation cannot be performed with standardized steps or procedures.
3. The above conventional device and the method thereof for adjusting the clamping force of a processed object may easily result in a too small force for clamping the processed object 10 between the pivotal rod sets 20 and 30 due to misjudgment so that the processed object 10 cannot synchronously rotate with the pivotal rod sets 20 and 30, or may easily result in a too large force for clamping the processed object 10 between the pivotal rod sets 20 and 30 so that the processed object 10 will hog. The two cleaning wheels 40 will respectively abut against two sides of the processed object 10, hence easily causing breakage of

the processed object 10 and damage of the cleaning equipment.

### **Summary of the invention**

One object of the present invention is to provide a device used for detecting the clamping force of a processed object and a method thereof, whereby the  
5 clamping force of the processed object can be detected to facilitate adjustment of the spacing between pivotal rods.

Another object of the present invention is to provide a device used for detecting the clamping force of a processed object and a method thereof, whereby the clamping force of the processed object can be detected and  
10 displayed when the clamping force of the processed object is being adjusted. Moreover, the clamping force can be quantified.

Another object of the present invention is to provide a device used for detecting the clamping force of a processed object and a method thereof, whereby the clamping force of the processed object can be detected to avoid a  
15 too small clamping force, hence letting the processed object synchronously rotate with the pivotal rod.

Another object of the present invention is to provide a device used for detecting the clamping force of a processed object and a method thereof, whereby the clamping force of the processed object can be detected to avoid a  
20 too large clamping force, hence preventing breakage of the processed object during the processing process and thus reducing loss of product and damage of equipment.

Another object of the present invention is to provide a device used for detecting the clamping force of a processed object and a method thereof,  
25 whereby the step of adjusting the clamping force of the processed object can be

easily standardized without the need of teach-and-learn of techniques and experiences.

To achieve the above objects, the present invention provides a device used for detecting the clamping force of a processed object and a method thereof.

5 The device of the present invention detects the clamping force of a processed object tightly clamped by several pivotal rods. The device comprises a basis component, a pressure detection component and a detection unit. The pressure detection component is disposed on the basis component. The detection unit is electrically connected to the pressure detection component to provide electric  
10 signal messages. The basis component having the pressure detection component is disposed between the pivotal rods to detect the clamping force.

The method of the present invention detects the clamping force of the processed object tightly clamped by the pivotal rods. The method comprises the following steps.

- 15 1. The spacing between the pivotal rods is first set to be commensurate with the longitudinal length of the processed object.
2. The basis component having the pressure detection component is placed between the pivotal rods with the pivotal rods closely leaning against the basis component. Simultaneously, the detection unit is  
20 electrically connected to the pressure detection component.
3. The detection unit detects variation of electric properties of the pressure detection component caused by stress strain and then provides electric signal messages.
4. The electric signal messages are exploited to adjust the spacing  
25 between the pivotal rods so as to adjust the clamping force of the basis

component having the pressure detection component.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawing, in which:

5    **Brief description of the drawings:**

Fig. 1 is a perspective assembly view of a conventional wafer cleaning apparatus for cleaning a processed object;

Fig. 2 is a side view of a conventional wafer cleaning apparatus for cleaning a processed object;

10    Fig. 3 is a diagram showing a conventional device used for adjusting the clamping force of a processed object and a method thereof;

Fig. 4 is a perspective assembly view of a device used for detecting the clamping force of a processed object and a method thereof according to a first embodiment of the present invention;

15    Fig. 5 is a perspective assembly view of a device used for detecting the clamping force of a processed object and a method thereof according to a second embodiment of the present invention;

Fig. 6 is a perspective assembly view of a device used for detecting the clamping force of a processed object and a method thereof according to a third  
20    embodiment of the present invention;

Fig. 7 is a side view of a device used for detecting the clamping force of a processed object and a method thereof according to the third embodiment of the present invention; and

Fig. 8 is a flowchart of a method used for detecting the clamping force of a  
25    processed object of the present invention.

## Detailed description of the preferred embodiments

As shown in Fig. 4, the present invention provides a device used for detecting the clamping force of a processed object and a method thereof. The device detects the clamping force of a processed object 10 clamped by several pivotal rods 21. The device comprises a basis component 60, a pressure detection component 70 disposed on the basis component 60 and a detection unit 80. The pressure detection component 70 is electrically connected to the detection unit 80. A display unit 90 electrically connected to the detection unit 80 is also provided. The basis component 60 having the pressure detection component 70 closely leans against and is placed between the pivotal rods 21 of the first and second pivotal rod sets 20 and 30 of a wafer cleaning apparatus. The pressure detection component 70 strains due to stress to generate variation of electric properties. The detection unit 80 detects the variation of electric properties of the pressure detection component 70, and the display unit 90 displays a value or an icon to show the clamping force in analog or digital way.

As shown in Fig. 4, the processed object 10 is a wafer or another object. The wafer cleaning apparatus is used to clean the surface of the processed object 10. Annular grooves 22 are disposed at end portions of the pivotal rods 21 of the first and second pivotal rod sets 20 and 30 of the wafer cleaning apparatus so that the basis component 60 having the pressure detection component 70 can lean against between the pivotal rod sets 20 and 30. Moreover, two sides of the pressure detection component 70 are locked between the annular grooves 22 of the two pivotal rods 21, and the side face of the pressure detection component 70 abuts against walls of the annular grooves 22.

As shown in Fig. 4, the basis component 60 can be made of silicon or

another material. The pressure detection component 70 is disposed near the pivotal rods 21 and at two sides of the basis component 60. The basis component 60 having the pressure detection component 70 is placed between and leans against the pivotal rods 21. The pressure detection component 70 strains due to stress to generate variation of electric properties. The detection unit 80 detects the variation of electric properties of the pressure detection component 70 and generates electric signal messages. The display unit 90 is used to display the electric signal messages to show the force of the pivotal rods 21 for tightly clamping the basis component 60 having the pressure detection component 70. The spacing between the pivotal rod sets 20 and 30 can thus be adjusted to adjust the clamping force.

As shown in Figs. 5, the pressure detection component 70 can be ring-shaped and disposed on the basis component 60, and contacts the pivotal rods 21. As shown in Fig. 7, the pressure detection component 70 can also be of a membranous shape and disposed at the side face of the basis component 60, and abuts against the pivotal rods 21.

The pressure detection component 70 can be made of piezoelectric material, which is tightly clamped by the pivotal rods 21 to strain due to stress. The magnitude of the strain of the piezoelectric material is utilized to generate a corresponding electric potential difference detected by the detection unit 80. The detection unit 80 then generates electric signal messages displayed by the display unit 90. The piezoelectric material can be quartz,  $\text{PbZrTiO}_3$ ,  $\text{BaTiO}_3$  or  $\text{ZnO}$ . The pressure detection component 70 can also be made of piezo-resistive material, which is tightly clamped by the pivotal rods 21 to strain due to stress. The magnitude of the strain of the piezo-resistive material is utilized to

generate a corresponding resistance variation detected by the detection unit 80. The detection unit 80 then generates electric signal messages displayed by the display unit 90. The display unit 90 can be lamps, a digital display or an analog indicator.

5 As shown in Figs. 4 to 8, the present invention also provides a method for detecting the clamping force of a processed object. The method detects the force of the pivotal rods 21 for tightly clamping the processed object 10. The method comprises the following steps.

1. The spacing between the pivotal rods 21 is first set to be commensurate  
10 with the longitudinal length of the processed object 10.
2. The basis component 60 having the pressure detection component 70 is placed between the pivotal rods 21 with the pivotal rods 21 closely leaning against the basis component 60. Simultaneously, the detection unit 80 is electrically connected to the pressure detection component 70.
- 15 3. The detection unit 80 detects variation of electric properties of the pressure detection component 70 caused by stress strain and then provides electric signal messages.
4. The electric signal messages are exploited to adjust the spacing between the pivotal rods 21 so as to adjust the clamping force of the basis  
20 component 60 having the pressure detection component 70.

Therefore, the device used for detecting the clamping force of a processed object and the method thereof can be utilized to detect the clamping force of the processed object 10 of a wafer cleaning and processing apparatus, thereby adjusting the spacing between the pivotal rods to adjust the clamping force.

25 To sum up, the device used for detecting the clamping force of a processed



object and the method thereof of the present invention have the following advantages.

1. Through a quantified value or an icon provided by the device used for detecting the clamping force of a processed object, the clamping force of the processed object can be easily detected, hence facilitating adjustment of the spacing between the pivotal rods.

2. The clamping force of the processed object can be detected and displayed. Moreover, the clamping force can be quantified.

3. A too large or too small clamping force of the processed object can be avoided:

4. Loss of product and damage of equipment can be avoided.

5. The clamping force of the processed object can be detected to standardize the step of adjusting the spacing between the pivotal rods without the need of teach-and-learn of techniques or experiences.

Although the present invention has been described with reference to the preferred embodiment thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have been suggested in the foregoing description, and other will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.